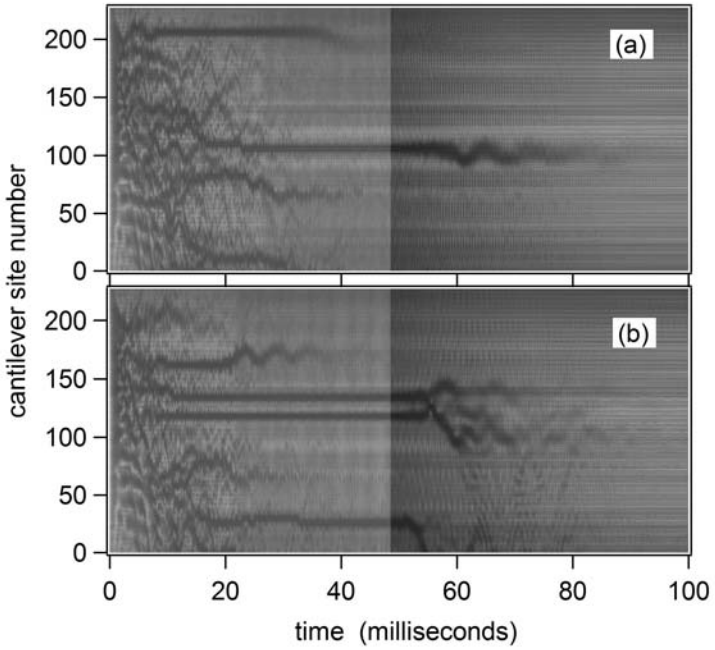
Experimental studies of nanoscale energy localization in periodic condensed matter systems

A. J. Sievers, LASSP, Cornell University, DMR-0301035

Dynamical localization in nonlinear periodic system, a relatively new discipline of condensed matter physics, has undergone intense growth in recent years and has ramifications and applications in many areas.

Our experimental study of micron scale micro-mechanical cantilever arrays has provided new insights into dynamical localization in nonlinear lattices that are driven by spatially uniform applied ac forces. The experimental cantilever excitation versus time data show the natural evolution from plane waves at short times to localized modes at long times.



Excitation versus time plots showing the transformation of cantilever displacements. Dark regions correspond to highly excited cantilevers. Plane waves near time = 0 are seen to break up into localized modes by 10 ms. The driver is turned off at 48 ms. (a) and (b) are for the same initial conditions.

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Education:

One undergraduate (Monica Pangilinan), three graduate students (Lars English, Bruce Hubbard and Molly Golladay), and two postdocs (N. Agladze and M. Sato) contributed to this research. Pangilinan entered graduate school, Fall 2003. English received his Ph.D. in the summer of 2003 and is presently an assistant professor at Dickinson College, Carlisle, PA.

Outreach:

The NATO Advanced Research Workshop in Erice, Sicily organized by the PI with DMR help brought together experts and students from around the world. The participants shown here, ranged from pure mathematicians to experimental physicists and engineers. Attention was focused on different aspects of nonlinear localization in a diverse variety of microscopic and macroscopic systems.